

- 1 1. A method of making a surgical instrument of the
2 kind that includes an inner tube disposed for movement
3 within an outer tube, comprising
 - 4 providing a tubular member to serve as either the
5 inner tube or the outer tube, the tubular member having an
6 open distal end, and
 - 7 swaging the distal end of the tubular member closed.
- 1 2. The method of claim 1 further comprising
2 performing the swaging by rotary swaging.
- 1 3. The method of claim 1 wherein the tubular member
2 includes a distal edge that defines an opening at the distal
3 end, the swaging comprising driving regions of the tubular
4 member disposed adjacent to the distal edge together to
5 close the opening.
- 1 4. The method of claim 3 wherein, prior to the
2 swaging, the distal edge is disposed symmetrically about an
3 axis of the tubular member, the swaging comprising driving
4 the adjacent regions of the tubular member together
5 symmetrically with respect to the axis.
- 1 5. The method of claim 3 wherein, prior to the
2 swaging, the distal edge is disposed perpendicularly to the
3 axis of the tubular member.
- 1 6. The method of claim 1 wherein the swaging
2 produces a seam in material of the tubular member at the
3 distal end, and further comprising fusing the material
4 together at the seam.

1 7. The method of claim 6 further comprising
2 performing the fusing by welding the distal end.

1 8. The method of claim 6 wherein the swaging
2 produces a protrusion of the tubular member material at the
3 seam, and further comprising cutting away a selected amount
4 of the protrusion prior to performing the fusing.

1 9. The method of claim 1 further comprising forming
2 the closed distal end of the tubular member into a selected
3 shape.

1 10. The method of claim 9 wherein the selected
2 shape is rounded so that the distal end defines convex
3 interior and exterior distal surfaces.

1 11. The method of claim 10 wherein the convex
2 distal surfaces are substantially hemispherical.

1 12. The method of claim 9 wherein the selected
2 shape is flattened so that the distal end defines flattened
3 interior and exterior distal surfaces.

1 13. The method of claim 9 further comprising
2 performing said forming by pressing the distal end between a
3 pair of dies that define the selected shape.

1 14. The method of claim 1 further comprising
2 providing the tubular member as the inner tube of
3 the surgical instrument, and
4 after the swaging, disposing a cutting implement at
5 the distal end of the tubular member.

1 15. The method of claim 14 further comprising
2 disposing the tubular member for rotation within the outer
3 tube of the surgical instrument.

1 16. The method of claim 1 further comprising
2 providing the tubular member as the outer tube of
3 the surgical instrument, and
4 after the swaging, defining a window at the distal
5 end for exposing a cutting implement carried by the inner
6 tube.

1 17. The method of claim 1 further comprising
2 providing a second tubular member to serve as the
3 other one of the inner tube or the outer tube, the second
4 tubular member having an open distal end, and
5 swaging the distal end of the second tubular member
6 closed.

1 18. A method of making a surgical instrument of the
2 kind that includes an inner tube having a closed distal end
3 disposed for movement within an outer tube having a closed
4 distal end, comprising
5 providing a tubular member to serve as either the
6 inner tube or the outer tube, the tubular member having an
7 open distal end,
8 swaging the distal end of the tubular member closed,
9 the swaging producing a seam in material of the tubular
10 member at the distal end and a protrusion of the tubular
11 member material at the seam,
12 cutting away a selected amount of the protrusion,
13 fusing the material together at the seam after the
14 cutting, and

15 after the fusing, forming the closed distal end of
16 the tubular member into a selected shape.

1 19. The method of claim 18 further comprising
2 performing the swaging by rotary swaging.

1 20. The method of claim 18 further comprising
2 performing the fusing by welding the distal end.

1 21. The method of claim 18 wherein the selected
2 shape is rounded so that the distal end defines convex
3 interior and exterior distal surfaces.

1 22. The method of claim 21 wherein the convex
2 distal surfaces are substantially hemispherical.

1 23. The method of claim 18 wherein the selected
2 shape is flattened so that the distal end defines flattened
3 interior and exterior distal surfaces.

1 24. The method of claim 18 further comprising
2 providing the tubular member as the inner tube of
3 the surgical instrument, and
4 after the swaging, disposing a cutting implement at
5 the distal end of the tubular member.

1 25. The method of claim 24 further comprising
2 disposing the tubular member for rotation within the outer
3 tube of the surgical instrument.

1 26. The method of claim 18 further comprising
2 providing the tubular member as the outer tube of
3 the surgical instrument, and

4 after the swaging, defining a window at the distal
5 end for exposing a cutting implement carried by the inner
6 tube.

1 27. The method of claim 18 further comprising
2 providing a second tubular member to serve as the
3 other one of the inner tube or the outer tube, the second
4 tubular member having an open distal end, and
5 swaging the distal end of the second tubular member
6 closed.

1 28. The method of claim 18 further comprising
2 conveying the tubular member between stations for
3 performing the swaging, cutting, fusing, and forming, and
4 controlling the conveying and coordinating operation
5 of the stations.

1 29. Apparatus for making a surgical instrument of
2 the kind that includes an inner tube disposed for movement
3 within an outer tube, comprising
4 a swaging station for receiving a tubular member
5 having an open distal end and for swaging the distal end of
6 the tubular member closed, whereby the tubular member can
7 serve as either the inner tube or the outer tube.

1 30. The apparatus of claim 29 wherein the swaging
2 station includes a rotary swager.

1 31. The apparatus of claim 29 wherein the swaging
2 produces a seam in material of the tubular member at the
3 distal end, the apparatus further comprising a fusing
4 station for fusing the material together at the seam.

1 32. The apparatus of claim 31 wherein the fusion
2 station comprises a welding device.

1 33. The apparatus of claim 32 wherein the swaging
2 produces a protrusion of the tubular member material at the
3 seam, the apparatus further comprising a cutting station
4 disposed between the swager and the fusion station, for
5 cutting away a selected amount of the protrusion.

1 34. The apparatus of claim 29 further comprising a
2 forming station for forming the closed distal end of the
3 tubular member into a selected shape.

1 35. The apparatus of claim 34 wherein the selected
2 shape is rounded so that the distal end defines convex
3 interior and exterior distal surfaces.

1 36. The apparatus of claim 35 wherein the convex
2 distal surfaces are substantially hemispherical.

1 37. The apparatus of claim 35 wherein the selected
2 shape is flattened so that the distal end defines flattened
3 interior and exterior distal surfaces.

1 38. The apparatus of claim 34 wherein the forming
2 station comprises a pair of dies that define the selected
3 shape for pressing the distal end therebetween.

1 39. Apparatus of making a surgical instrument of
2 the kind that includes an inner tube having a closed distal
3 end disposed for movement within an outer tube having a
4 closed distal end, comprising

5 a swager for receiving a tubular member having an
6 open distal end and for swaging the distal end of the
7 tubular member closed, whereby the tubular member can serve
8 as either the inner tube or the outer tube, the swaging
9 producing a seam in material of the tubular member at the
10 distal end and a protrusion of the tubular member material
11 at the seam,

12 a cutting station for cutting away a selected amount
13 of the protrusion,

14 a fusion station for fusing the material together at
15 the seam after the cutting, and

16 a forming station for forming the closed distal end
17 of the tubular member into a selected shape.

1 40. The apparatus of claim 39 wherein the swaging
2 station includes a rotary swager.

1 41. The apparatus of claim 39 wherein the fusion
2 station comprises a welding device.

1 42. The apparatus of claim 39 wherein the selected
2 shape is rounded so that the distal end defines convex
3 interior and exterior distal surfaces.

1 43. The apparatus of claim 42 wherein the convex
2 distal surfaces are substantially hemispherical.

1 44. The apparatus of claim 39 wherein the selected
2 shape is flattened so that the distal end defines flattened
3 interior and exterior distal surfaces.

1 45. The apparatus of claim 39 further comprising

2 devices for conveying the tubular member between the
3 stations, and

4 a controller for controlling the devices and
5 coordinating operation of the stations.